+/-180degree Inclinometer

# MSENS-IN

# User's Manual


DAS

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# Contents

## Before using

1. This equipment is versatile as a tilt sensor, use the following information to be checked.
2. Check used to test the power. 10 ~ 30Vdc voltage is used. In noisy environments must be connected to the ground.
3. Tilt sensor is a gravity-based equipment is measured. This is based on the direction of gravity. Please check the directions.
4. Connect the correct cable to determine the index, please. Incorrect connection may result in damage of the equipment.
5. 1 year warranty on this product.

## 1. Introduction

MSENS-IN uses a three-axis acceleration sensor. This can be measured in all directions, and measuring the angle -180~+180 degrees, so there is no limit measure. 3-axis acceleration sensor mutual temperature compensation. Microprocessor is equipped with 3 poly-fit look with high precision and linearity. The user settings can be stored in internal memory of sensor. (direction, the analog output range, the sensor ID, specify the initial value, etc.) In addition, because the sensor RS-485 communication can be connected to more than 1Km, a line can be connected to Maximum 80 sensors. Core sensor shield to prevent penetration through the strong noise, motors, etc. can be used in strong noise environment. Sensors have been molded silicone inside can be used in inclement weather.

## 2. Specification

### 2.1. Dimensions

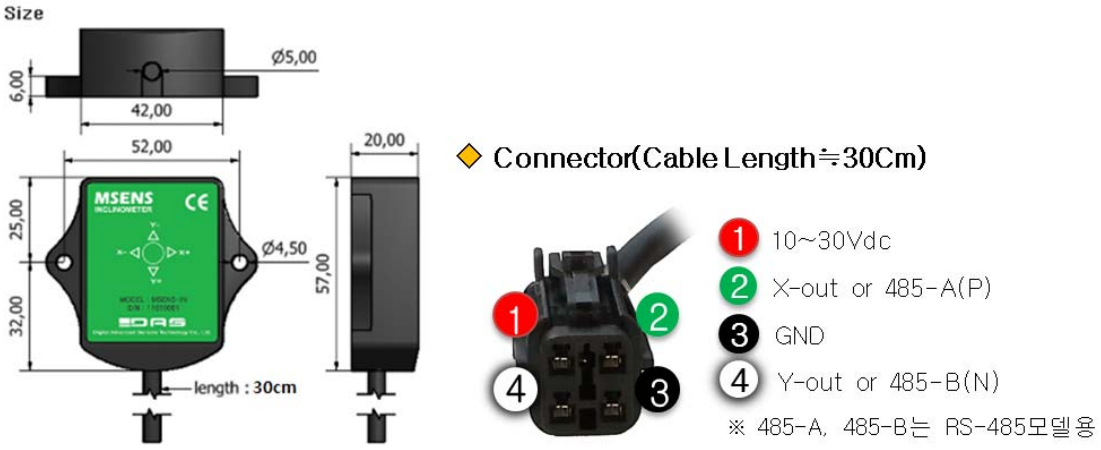


fig2.1 MSENS-IN Dimensions

### 2.2. Technical specifications

**1) Measuring Range**

- RS-485 out : 0 ~ 360도 Full-Range

**2) Core sensor & CPU**

3 axis 1g accelerometer

32bit ARM micro processer

**3) Power**

Typical : 12Vdc

The sensor was unregulated power(10~30Vdc) supply is also available.

**4) Current**

<150mA at 12Vdc

**5) Resolution**

0.1 Degree

**6) Max total error**

0.25%(FS)

**7) Output**

① RS-485 : Output Interval 50mSec

- Serial Setting : 9600, 8, 1, none
- output format : Hex 02 + **359.90** + Hex 17 + 06 + Hex 24
  = STX + **ANGLE** + ETB + Checksum + $
- Checksum : Checksum of the way down by the 'XOR' operation is calculated by.
  Hex 02 XOR '3' XOR '5' XOR '9' XOR '.' XOR '9' XOR '9' XOR Hex 17 XOR
  Or with completely hexadecimal notation:
  02 XOR 33 XOR 35 XOR 39 XOR 2C XOR 39 XOR 39 XOR 17 XOR = 06

② mA : Users select mA/mV when ordering

- Low-angle end: 4.32mA
- High-angle end: 19.68mA
- Center-angle : 12mA

③ mV : Users select mA/mV when ordering

- Low-angle end: 100mV (Change is possible(100 ~ 1000mV))
- High-angle end: 4,900mV(Change is possible(4,000 ~ 4900mV))
- Center-angle : Center value between Low-angle out with High-angle out

**8) Turn-on Time**

<50mSec

**9) Housing**

IP66, PVC Case

Water-proof Housing : The Sensor can be waterproof silicone molding.

**10) Operating Temperature**

-20 to .. +85°C

**11) Weight**

about 68g

**12) Cable**

5P Shield cable, 50cm ( * cable may have changed )

## 3. Wiring

MSESE-IN360 for a five-stranded shielded cable is used. Supply voltage 2-line, RS-485 2-line, mA output consists of a line. RS-485 and the unused line of mA output does not touch the other by cutting the cable must be insulated. When using RS-485 distance is longer than 50M 120 Ohm termination is recommended. In addition, if multiple sensors connected in parallel to use in the termination resistors.

### 3.1. RS-485 Wiring

RS-485 communications can be read sensor value when the one or more sensors can be connected in parallel to a line. However, caution this time, each sensor's ID to be different, continuous data read (# READ) instruction, such as ID and to answer all the sensors, regardless of instruction should not be used. And when you use multiple sensors to allow sufficient power supply wiring should be designed.

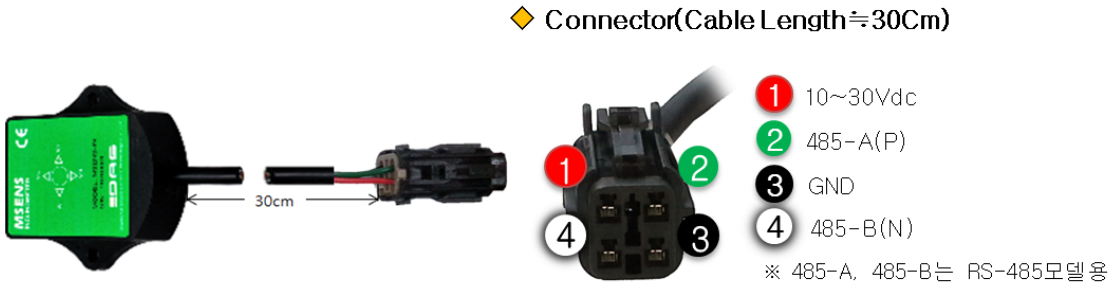


fig 3.1 Cable Index

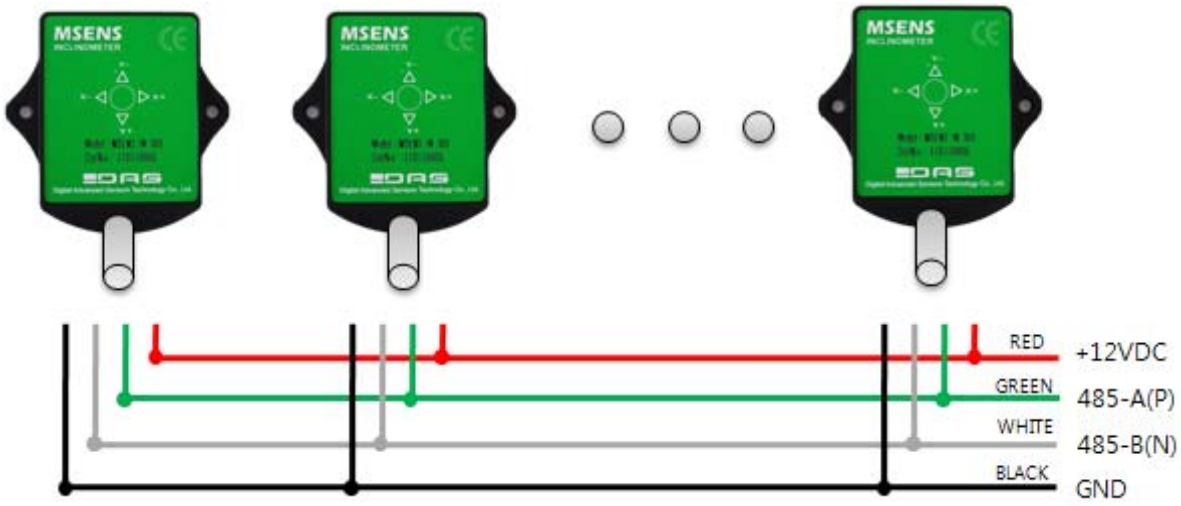


fig3.2 RS-485 Parallel connection diagram( * cable may have changed )

### 3.2. Analog mA Wiring

The analog output mA output. The 485 can not be like a parallel connection.

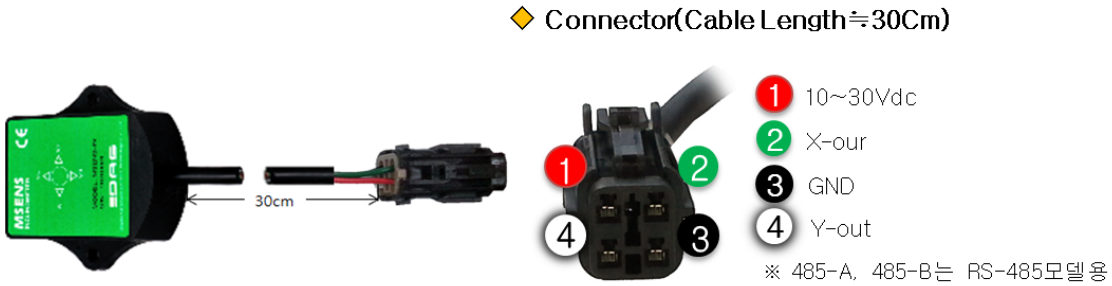


fig3.3 Analog output Cable index ( * cable may have changed )

## 4. Communications and command

### 4.1. Communication Settings

Set the following values 485 need to communicate.

Baudrate : 9600
Data Bits : 8
Stop Bits : 1
Parity : none

### 4.2. Command

#### 1) Data Read

First of all the transfer of 'CR / LF' will be sent by appending. Reading instruction for the sensor values are two kinds. The first '# READ' and the second one 'B0 05' is the first to send the ASCII code, the second will be sent to the hex code. Where 'B0' means the sensor ID. Sensor ID is '0 xB0 'in the '0 xFF ' is to be a total of 80ea.

(1) ASCII

ex) #READ+CR+LF => Sensors will send data continuously.(Output Interval 50mSec)

ex) #DATA+CR+LF => Sensors will send data to a week.

(2) HEX

ex) B0 05 => ID is 0, the sensor will send data to a week.

#### 2) Stop transfer

'# READ' command to transfer data continuously. If you stop the transfer of data '# STOP' to send commands. After all the commands 'CR / LF' will be prefixed with.

ex) #STOP+CR+LF => Stop data transfer

#### 3) ID Setting

Sensor ID is '# ID {NO}' can be changed to. After all the commands 'CR / LF' will be prefixed with.

ex) #ID1+CR+LF => Sensor ID set to 1
=> Return message : #OK+CR+LF

ex) B1 05 => Sensor value of sensor 1 ID0 transmission (transmission as a hex code)

**4) Direction and positioning sensors installed**

M360 install the sensor according to the position of the direction and angle, you can specify the detection method. For example, the sensor attached to the wall and counter-clockwise rotation angle of 0-360 if you want to output, '# MODE' command can be set.

Sensor direction is selected by user when ordering.

Wall / floor mount　　X / Y direction

fig4.1 Sensor Direction

ex)#MODE1+CR+LF => The bottom of the sensor installation, increasing clockwise rotation
=> Return message : #OK+CR+LF

**5) 0 ° positioning**

0 degrees is used to specify the location. For example, if the current angle of -10.5 to 0 degrees if you want it, use this feature. At this point, enter the input value multiplied by 10, you must enter an integer only.

ex)#OFFS-105+CR+LF => 0 to move back as the position of -10.5.
=> Return message : #OK+CR+LF

**6) Specify the analog output of measured angular range (For professional use.)**

Analog output (mA) and 4.32 ~ 19.68mA output stage is shown. At this point you want to measure only the desired angle range, the user can specify a range of settings with the command. For example, when -30° to +30° then output is 4.32mA to 19.68mA. At the end of all the commands 'CR / LF' will be prefixed with.

CALI Set the value according to the value defined
C => Specify the lower angle range (example. -30 degrees)
D => Specify the Higher angle range (example. -30 degrees)

ex)#CALIC-30+CR+LF => Measured from -30 degrees (4.32mA)
#CALID30+CR+LF => Measuring up to 30 degrees (19.68mA)

If the above settings, the analog output -30 to 30 degrees and 4.32 ~ 19.68mA output is detected. -180 to -30 degree and 4.32mA out, and from +30 to +180 degree 19.68mA output.

**7) Get sensor information**

The set of sensor information and can determine the version of sensor.

ex) #INFO+CR+LF => Sensor information transfer

=> Return message : MSENS-IN360 Ver:1.00,ID:B0,MODE.....